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The Critical Period for the Acquisition of Language: Some Cognitive Developmental Considerations

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ABSTRACT

This paper reviews the biological origins of the critical period hypothesis and the neurophysiological evidence which was initially supplied in support of a critical period for the acquisition of language. Noting the inconclusive nature of neurophysiological evidence, the author suggests that we look to the interplay of affective and cognitive factors in discussing the acquisition of a second language. The main focus of this paper is the consideration of Piagetian cognitive developmental theory in general, and the development of the symbolic function in particular as it relates to the problem of second language acquisition. The suggestion is offered that the onset of Formal Operations may well mark the beginning of the end of a critical period for the acquisition of language.

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The notion that there is a critical period for the acqui ition of language (a first language) and by extension for the acquisition of a second language, is not a new one. The concept of a critical period derives from the behavior observed in geese (Lorenz, 1970), dogs (Denenberg and Smith 1963), and other animals whereby a particular behavior is acquired given particular stimulus conditions, at a particular point in the development of that animal. The period of time for the acquisition of that behavior became knownas the critical period for acquisition. It is alleged by Hess (1964) that behaviors learned traditionally during a critical period, <u>can</u> be learned after the close of the critical period, but via alternate routes. This allegation is not unanimously supported in the biological/psycho-biological field however, as evidenced by the claim made by Nash (1970) who suggests that the same treatment effected at a non-critical time, may have no effect on the critical event. He goes on to say that:

> From all the work done on critical periods, it would seem that such alternate routes, even if possible are more difficult and that even if the results are phenotypically similar, they are virtually different.

This biological concept of critical period has been applied to language acquisition. Although the history of this interpretation is fairly clear, the supporting neurophysiological evidence is not. Penfield and Roberts (1959) were among the first to suggest that the ability to acquire a second language after puberty, the traditional endpoint of the critical period for language acquisition, would be more difficult if not impossible after that time. Lenneberg (1967) more than any other is probably responsible for popularizing the notion, based on work of his own and that of Basser (1962) and others. Much of the evidence presented by Lenneberg is based on the recovery of language function by aphasics of varying ages. The argument rests on the neurophysiological phenomenon of cerebral lateralization of function which Lenneberg alleges is not complete until puberty. Although Lenneberg presents other supporting evidence for his claim of a critical period for the acquisition of language gradually ending around puberty, including the progress of language acquisiton in the hearing impaired and mentally retarded, the bulk of his claim rests on the course of cerebral lateralization of function and transfer of function. While Lenneberg argues that lateralization is not complete until puberty, Geschwind (1972) suggests a much earlier functional assymetry and Krashen (1973) in reanalyzing the Basser data on which Lenneberg

draws, claims lateralization to be complete by age 5. Krashen does allow that transfer of function may still continue until puberty. Kinsbourne[1] at a recent conference of the New York Academy of Sciences placed lateralization in the neonatal period, thus further confounding the entire issue.

And yet in spite of these neurophysiological counter findings, there is still a solemn belief in a critical period for language acquisition which ends around puberty. Even among researchers who find similar patterns in ESL acquisition among adults and children[2] such as Krashen (1974) there is still a belief in a critical period. Since both anecdotal evidence and the personal experience of ESL teachers and researchers tell us that children learn second languages with greater facility and with better accents than do adults, the search has continued for other evidence to support the critical period hypothesis. Since neurophysiological evidence to date is inconclusive, two other explanatory areas have emerged: affective factors and cognitive factors.

Although it is the bias of this writer that these two factors cannot in any meaningful way be divorced one from the other, since it is likely that they interact in determining the receptivity of the language learner, this paper will summarize some new thinking as regards cognitive factors, all the while realizing that cognitive factors alone, are probably not responsible for the close of the critical period for the acquisition of language.

This paper will explore specific cognitive factors which may contribute to a critical period for the acquisiton of language. The course which will be followed will be to briefly examine and compare the conceptualization of language acquisiton from the theoretical viewpoints of Chomsky and Piaget, and finally based on the developmental theory of Piaget identify the onset of Formal Operations and its concomitant cognitve structures and operations as the beginning of the end of the critical period for the acquisiton of language - first or second.

It is well knownthat for Chomsky (1957), language or the capacity for language acquisition and the LAD are innate. Environmental input is critical only insofar as it provides linguistic input upon which the learner may draw in formulating hypotheses about that input; hypotheses which the "...child cannot help constructing..." (p.59) As for input, Piaget argues (1958) that:

> The maturation of the nervous system can do no more than determine the totality of possibilities and impossibilities at a given stage. A particular social environment remains indispensable for the realization of these possibilities... their realizations can be accelerated or retarded as a function of cul-

tural and educational conditions.

Sinclair de Zwart (1972) suggests that we can consider the Chomskian tradition as conceptualizing language acquisition in terms of a "knower-known" relationship where language is something to be known. She points out that Chomsky overlooks the "knower-symbolization-known" relationship. This distinction seems to be of critical importance to a theory of language acquisition, as opposed to a description of adult language which is the direction in which Chomsky comes at language. As a result of Chomsky's considering language as the "known", he assumes that the child begins learning language as a system of signs rather than signals and symbols with which to represent his thought (the Piagetian "known"). De Zwart goes on to explain that the "need for postulating specific innate language structures vanishes if you consider [first] language acquisiton within the total cognitive development and particularly within the frame of the symbolic function.

The child's response to his environment changes as he not only reacts to objects and events but as he comes to "know" them and can express this "knowledge" in terms of signifiers. For the Piagetian model - an active organism model- the necessary conditions for the start of language learning are not based on innate mechanisms but rather on "the coordinations of sensorimotor schemes which are actively built up during the lst 18 months of life..." Piaget (1970) observes that "... it is very striking that language does not appear in children until the sensorimotor intelligence is more or less achieved." (p.47).

Language then, begins to develop at the end of the sensorimotor period along side of other symbolic functions, that is other means of abstractly representing what the child knows. From the sensorimotor period the child continues to assimilate and accommodate his cognitive structures to new content. It is presumably during the course of progressive cognitive development with its gradual trend toward decentration that the child is also acquiring new linguistic forms - not as forms to be learned per se, but as vehicles for expressing his thoughts. The developing child's task is not the overt task of learning more complex linguistic forms or a completely new system of forms (a second language), as an end in itself,but only insofar as these forms enable him to more abstractly represent his thoughts in accordance with his developing cognitive capacities.

Structural change is a fundamental aspect of the Piagetian model. Cognitive structures change from stage to stage with assimilation and accommodation to new content until the Formal Operational period is reached. Each stage change is characterized by disequilibrium which somehow thrusts the child over the brink and into the next stage. Each new stage of development extends the one prior to it, reconstructs it in a different manner and later surpasses it. Concrete Operations, the stage of cognitive development running from age 7 or 8 to roughly 11 or 12, can be described as a logic of classes and relations. Concrete Operations involve the additive and multiplicative operations upon classes and relations, allowing the child to perform classifications, seriations, correspondences, etc. These abilities seem to be necessary for dealing with linguistic input be it intuiting transformational rules inherent in that input, or merely being able to classify according to developing probabilistic assumptions based on frequency in the input.

At around age 11 or 12 (Ausubel'66 places this date at around 15 to 20), the newly emerging formal thought restructures Concrete Operations not by discarding them but by restructuring and then subordinating them to new structures. Piaget describes the transition from Concrete to Formal Operations as a gradual structuring of a formal mechanism achieved by superimposing propositional logic of classes and relations - a process which reaches an equilibrium point at about 14 or 15 years.

Relative to the Piagetian theory there are a few questions we might ask: what in the nature of Formal Operations might be an inhibiting factor to further language learning? Does something (operation) compete with language acquisiton operations so that the child is no longer able to learn language? Perhaps the problem is not in any single operation but rather in the whole nature of cognitive development, i.e. the progressive decentration, progress from the static to the dynamic, and the flexibility brought on by reversibility. For example, initial language acquisition takes place when the child is highly centered. He is not only egocentric at this time, but when faced with a problem he can focus (and then only fleetingly) on one dimension at a time. This lack of flexibility and lack of decentration may well be a necessity for language acquisition. Perhaps the immature form of cerebral organization as

characterized by these "limiting" structures are necessary. Centration in particular, implies very little meta awareness, an ability most adults have and use. Even in the Concrete Operational child who is already somewhat decentered:

> ... he preserves both an astonishing degree of ignorance and a striking insensitivity, not only to his own designation ... as Swiss, French, etc... but toward his own country as a collective reality. This is to be expected since in the 7-11 year old child, logic is applied only to concrete or manipulable objects. (1958, p.348)

This last point can be seen as reflecting on the naturalness of first language learning in the sense that the young child does not generally know that he is acquiring a language, and he cannot step back as it were, and observe his accomplishment. Even young bilingual children generally have become that way rather facilely and without much thought about it. The child, in addition to lacking this type of meta-awareness, also has not yet acquired social attitudes towards one or the other language, although he does acquire the sociolinguistic rules for the uses of one or both languages and thereby will ultimately come to internalize the social norms concerning their differences. This of course raises an interesting consideration in terms of language acquisition after the critical period, namely the differences in underlying motivations for second language learning and attitudinal predetermination, a topic which has been considered at some length by Schumann (1974).

In considering Piaget we must take into account the overriding process of equilibration. Lenneberg, like Piaget considers that language acquisition can only occur in a state of disequilibrium, or as he puts it, during a state of "language readiness" which is characterized by disequilibrium and is marked by a state of equilibrium at its close. Piaget claims that a final state of equilibrium is not reached until Formal Operations which are not firmly organized until at least 14 or 15, the same age after which language acquisition does not seem to be able to occur, and the same age at which 2nd language learning, while not impossible, is reported to be at best labored and usually incomplete. What accounts for the seeming correlation between the progressive inability to acquire language and the progressive attainment of logical operations whose acquisition is marked by a state of equilibrium? One possibility, suggested by Lenneberg, is that when language is learned during the critical period, perhaps what the child attends to is similarity of generative principles rather that differences in surface structures. Interestingly, Inhelder and de Zwart (1969) have made a similar though more general observation about the growing awareness of differences in cognitive

development.

> The awareness of contradictions seems to act as an incentive to decentration: the child begins to search for both the similarities and the differences between two problems and this may finally lead him to a true new acquisition in a new and different field. (p.20)

We may speculate that if decentration is somehow inversely related to language acquisition ability (the ability to extract similarites in generative principles between 2 languages, in the case of second language acquisition), and if awareness of contradictions acts as an incentive to decentration, then perhaps what acts as a 'block' to language learning, is precisely the awareness of differences. This new consciousness of differences seems to supplant the child's previous limitation of being able to only focus on the underlying similarities. Although we do not know what in particular interferes with the ability of the Formal Operational person to explore the similarities without the concomitant differences, we can at least grant that the Formal Operational thinker seems to have a great deal of difficulty with this task. Given that this is an accurate description, we are faced with the problem of getting around the 'blocks.'

Given the 'limitations' of the Formal Operational thinker, namely the access he has to all possibilities via his logical structures (since all possibilities invites the possibility of the consideration of differences between 2 languages and the consideration of social attitudes towards the second language) what sort of approach ought we take with regard to teaching adults a second language? One approach to teaching adults a second language should be based on the assumption that Formal Operational structures are different than Pre-Operational and Concrete Operational structures, that the cognitive climate in not the same as it was in childhood, and that we can recreate neither the old climate nor the former way of structuring. Since we cannot go backwards, regress, to more immature modes of thought, we must design our task (the acquisition of a second language) more in conformity with other Formal Operational tasks. Let us construct Formal Operational language acquisition such that it appears to the learner as a problem to be solved using his hypothetico-deductive logic. In other words, let us adopt Hess' view of a critical period wherein the critical behavior can be learned outside the critical period, but via an alternate route. The solution, based on Hess' views, and based on Formal Operational logic, seems to be therefore to provide instruction in those abstract aspects of language which the adult has become sensitive to. [3.]

Primarily there are 2 objections to this line of thinking. First of all the approach of using hypothetico-deductive thinking in the solving of a problem (the acquisition of a second language) is problematic since one performs such logical operation through the use of language - the native language. How then do we get the learner to use the new language if he is operating in his first language? It is a paradoxical situation in that his operational abilities far outweigh his facility in the new language at the onset of his attempt to learn the new language. Since he is Formal Operational he will continue to 'think' and in the service of this all-pervasive activity, use his system of symbols (his first language). Thus he will not be able to use his new language for all the symbolic representation for which he uses (quite unconsciously) his first language. Even deliberate attempts to teach language in this way may run aground precisely because of the competition the use of a new symbol system will receive from an already established functionally integrated system of symbols - the first language. A second problem with this approach is that language is not something to be "known" for Piaget. Language arises out of the "knower-symbolization known" dynamic and therefore must emerge as a representational form of the "known." It seems to me that within the Piagetian framework there is no room for adult second language acquisition in and of itself.

One way out of this dilemma does remain however. Chomsky's conceptualization of language came out of a tradition of describing the language behavior of adults. His description of language as something to be "known" may provide us with just the description we need for detailing the language learning ability of adults. What this suggests is that adults <u>do</u> learn language via an alternate route, namely as a "known", and that they most likely require instruction in the 'subject' (the second language). If we accept this view however, we must also consider Nash's misgiving about the final outcome of this learning process. We must be wary that "even if the results are phenotypically similar, they [may be] virtually different."

FOOTNOTES

1. Kinsbourne, M. Paper delivered at the New York Academy of Sciences Conference on Developmental Psycholinguistics and Communicative Disorders. January, 1975. Proceedings forthcoming.

2. Madden, C., Bailey, N., and Krashen, S., The acquisition of function words by adult learners of English as a second language: evidence for universal strategies. Proceedings of the 5th Meeting of the Northeastern Linguistics Society. 1974. (in press).

   Krashen et al found, using the BSM (Dulay & Burt, 1973) which assesses the difficulty ordering of 8 English morphemes, an ordering for adult ESL students which was similar to the difficulty ordering of children acquiring English as a second language, found by Dulay and Burt.

3. Krashen, in Madden, Bailey and Krashen (1974), and in a recent paper at the New York Academy of Sciences (January,1975), also suggests that "The adult's desire to have a conscious understanding of language may be just what prevents him from attaining full competence... The Formal Operations hypothesis thus predicts both the "incompleteness" and "unnaturalness" of adult second language learning." In support of the Formal Operations hypothesis, he also cites concomitant affective changes which occur during (or as a result of) Formal Operations.

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